

Soils: Course Outline

- I. Natural History of Soils in Iowa
 - A. Soil Forming Factors
 - 1. Parent Material
 - a. Glacial Drift
 - b. Loess
 - c. Colluvium
 - d. Alluvium
 - e. Organic (Muck & Peat)
 - 2. Organisms
 - a. Plants
 - b. Animals (Including Humans)
 - 3. Climate
 - 4. Topography
 - 5. Time
 - B. Components of Soil
 - 1. Chemical
 - a. pH
 - b. Calcareous
 - 2. Physical
 - a. Soil Texture (percent)
 - i. Sand
 - ii. Silt
 - iii. Clay
 - b. Color (Munsell Color Book)
 - c. Weathering
 - d. Soil Structure
 - i. Granular
 - ii. Platy
 - iii. Blocky
 - iv. Prismatic
 - v. Massive
 - vi. Single Grain
 - e. Drainage
 - C. Soil Types and Classes
 - 1. Use and Management
 - 2. Horizons
 - 3. Land Capability Classes
 - 4. Erosion Phases
 - 5. Interpretations
 - D. Land Form Regions
 - 1. Geologic Origins
 - 2. Impacts on Ecology
 - E. Native Vegetation
 - 1. Impacts on Soil Development

- a. Forests
 - b. Prairies
 - c. Wetlands
- II. Soil Ecology
 - A. Defining Soil Ecology
 - B. Biotic Factors
 - C. Nutrient Cycles
 - D. Abiotic Factors
- III. Soil Management
 - A. Land Use In Iowa
 - 1. Private Ownership
 - 2. Public Ownership
 - 3. Agricultural
 - a. Row Cropped
 - b. Hay
 - c. Pasture
 - d. Private Forests
 - e. Water Covered
 - 4. Non-Agricultural
 - a. Incorporated Areas
 - b. Recreational Areas
 - c. Roads
 - B. Conservation/Tillage Practices
 - 1. Erosion
 - a. RUSLE2 (Soil Loss Equation)
 - 2. Siltation (Deposition)
 - 3. Drainage Systems
 - a. Surface
 - b. Subsurface
 - 4. Residue Management
 - a. No-Till
 - b. Terraces
 - c. Drainageways
 - d. Filter Strips
 - e. Buffer Strips
 - 5. Soil Properties
 - C. Equipment
 - 1. Soil Survey Books
 - 2. EFOTG (Electronic Field Office Technical Guide)
 - 3. Munsell Color Book
 - 4. Clinometer
 - 5. Soil Quality Test Kit
 - 6. Soil Probes
 - a. Hand

- b. Hydraulic
 - D. Economics
 - E. Agencies
 - 1. USDA-NRCS
 - 2. DNR
 - 3. SWCD
 - 4. FSA
 - 5. CDI
 - 6. IDALS-DSC
 - 7. Extension Service
 - F. Programs
 - 1. Local
 - 2. State
 - 3. Federal
- IV. Careers
 - A. Governmental
 - 1. Local
 - 2. State
 - 3. Federal
 - B. Private
- V. Appendix
 - A. Terms
 - B. Resources
 - C. Curriculum Standards
 - 1. Agriculture
 - 2. Science

Soil: Terms

A-horizon
alluvium
B-horizon
bottomland
buffer strip
C-horizon
calcareous soils
classes of erosion
clay
colluvium
conservation tillage
contouring
corn suitability rating - CSR
drainage
E-horizon
erosion
external soil features
fertility
filter strip
footslope
forest vegetation
glacial drift
grass waterway
gully erosion
humus
infiltration
intermittent drainageways
internal soil features
landform
landscape position
landscape topography
leaching
limited (rating)
loess
loam
macro nutrients
marsh vegetation
micro nutrients
moderate (erosion rating)
mottling
muck
native vegetation
no-till

not limited (rating)
nutrient cycles
O-horizon
organic matter
parent materials
peat
percolates
permeability
prairie vegetation
R-horizon
residuum
rill erosion
RUSLE2
sandy clay
sandy clay loam
sandy loam
seepage
severe (erosion rating)
sheet erosion
shrink-swell
silt
silty clay
silty clay loam
silty loam
slight slope
soil components
soil conditions
soil conservation practices
soil profile
soil ratings
soil texture
strip cropping
surface drainage
subsurface drainage
terrace
terracing
tilth
transition vegetation
upland
very limited (rating)
weathering
wetness

Soil: Resources

The following resources were suggested by the writers and reviewers. There are many additional resources available and many more being developed daily, especially via the web. Website resources contain lists of publications related to specific topics. Individual books or pamphlets were not listed because of space. Please view these as a starting point and add others to the list as you develop your specific course objectives.

Websites:

Conservation Districts of Iowa

Conservation Districts of Iowa (CDI) is a nonprofit organization devoted to providing educational programs on the conservation of soil, water, and other natural resources. CDI coordinates Iowa's Envirothon program.

<http://www.cdiowa.org>

Iowa Department of Agriculture and Land Stewardship

Information and publications related to Iowa's Agriculture and Conservation/Natural Resource issues and programs

<http://www.agriculture.state.ia.us/default.htm>

Iowa Department of Natural Resources

Informational materials on Geology, Geologic Resources, Topographic Maps

<http://www.igsb.uiowa.edu/>

Iowa State University Extension Publications

Extensive publication list related to soils, soil judging, and management.

<http://www.extension.iastate.edu/pubs>

United States Department of Agriculture (USDA): Natural Resources Conservation Service (NRCS)

Informational materials on soils, soil management, soil science, soil surveys

<http://www.soils.usda.gov>

Books & Pamphlets:

Iowa's Natural Heritage. Iowa Academy of Science and Iowa Natural Heritage Foundation. 1982. Call Iowa Natural Heritage at 1-515-288-1846.

Landforms of Iowa. Jean C. Prior, IDNR, order at <http://www.iowadnr.gov/pub.html>

Managing Our Natural Resources. Camp, William G., et al. 2002. DELMAR, 4th ed.
<http://www.Agriscience.Delmar.com>

Professional Soil Classifiers of Iowa Soil Texture Kit,
<http://www.agron.iastate.edu/soilsurvey/#PSCI/>

Soil Survey Books. Contact your local USDA Service Center Office, or
<http://www.soils.usda.gov/survey>

Soils: Curriculum Standards and Benchmarks

Agricultural Education

Standards, Benchmarks, and Performance Indicators

Agricultural Business, Supply & Service

Standard AB-1: Understand problem-solving, analysis, and decision-making in agriculture.

Benchmarks

A. Analyze situation, use problem-solving approach and make appropriate decisions.

3. Interpret the results from a soil and/or tissue test.
4. Determine appropriate land use management based on soil evaluation needs.

Standard AB-12: Understand basic technical skills and knowledge in the occupational area of agricultural business, supply and service.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

32. Identify the types of tillage methods used in crop production.
34. Explain the role of primary and secondary nutrients used in crop production.
39. Read a soil classification map.

Agricultural Production

Standard AP-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

1. Evaluate and demonstrate use of current technology in land surveying and measuring.
2. Utilize digitized soil surveys to establish a soil sampling method and formulate a nutrient.

Standard AP-12: Understand basic technical skills and knowledge in the occupational area of production agriculture.

Benchmark

K. Apply technical skills in a hands-on experiential setting in agriculture.

4. Analyze the environmental effect that agricultural stewardship may have on surface and ground water, wildlife, soil, air, and people.
19. Explain soil and water conservation practices and their part in federal program compliance.
20. Explain the factors involved with seed and plant selection.

21. Identify and demonstrate plant growth and reproduction.
22. Identify and select biological and chemical pest controls for agronomic production.
34. Use the survey plat of township, range and section to describe an area.

Horticulture

Standard H-1: Understand problem solving, analysis, and decision-making in agriculture.

Benchmarks

A. Analyze situation, use problem-solving approach and make appropriate decisions.

3. Interpret data of soil sample analysis.
5. Choose an appropriate plant for a specific location in a home or business.

Standard H-12: Understand basic technical skills and knowledge in the occupational area of Horticulture.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

2. Take soil samples
52. Explain factors affecting plant growth: light, water, temperature, humidity, nutrients (micro/macro), soils, atmosphere, and pollutants.

Natural Resources

Standard NR-1: Understand problem solving, analysis, and decision-making in agriculture.

Benchmark

A. Analyze situation, use problem-solving approach and make appropriate decisions.

1. Assess and implement BMPs (Best Management Practices) related to agriculture drainage wells, erosion control, irrigation of wastewater, irrigation of groundwater, use of storage tanks (i.e., fuels, Anhydrous Ammonia, etc.) and wellhead and source of water protection which improve water quality.
8. Determine soil amendments necessary based on soil tests, realistic yield goals, and the fertility level of a given piece of land.
9. Identify and evaluate conservation tillage systems and their productivity, profitability and environmental impact.
12. Evaluate various solid waste disposal systems by their environmental impact.

Standard NR-4: Understand the use of entrepreneurial knowledge and skills in agriculture.

Benchmark

D. Use appropriate communication skills in a variety of occupational situations in agriculture.

3. Recognize the importance of technical assistance.

Standard NR-7: Understand the principles of planning.

Benchmark

G. Apply planning strategies in natural resources management.

6. Develop plans which incorporate the use of federal, state, and local agriculture programs to sustain resources (i.e., buffer strips).

Standard NR-8: Understand the concept of adapting to change in agriculture.

Benchmark

H. Develop strategies to effectively adapt to new situations and rapid changes in agriculture.

1. Identify contemporary natural resources issues/concerns relating to agriculture.
2. Adapt to environment/situation.

Standard NR-9: Understand global and cultural diversity issues.

Benchmark

I. Demonstrate a working knowledge of the relationship between global/cultural diversity and occupational success in agriculture.

1. Describe global environmental impact.
2. Explain global positioning systems and graphic information systems and understand practice application.

Standard NR-10: Understand basic computational and informational technology.

Benchmark

J. Apply computational and informational technologies to analyze and solve mathematical problems.

2. Measure and calculate land area, length, and percent slope.

Standard NR-11: Understand the concept of career development and improvement – lifelong learning.

Benchmark

K. Develop strategies to make a successful transition from school to work.

1. Identify a minimum of five (5) environmental and natural resource occupations and explain the job requirements, major activities performed by persons in these occupations and availability by location.
2. Explain the connection between the natural resources occupations, agribusiness, and technology.

Standard NR-12: Understand basic technical skills and knowledge in the occupational area of natural resources.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

1. Explain the economic impact of the loss of wildlife, habitat, urban sprawl, and navigation on wildlife resources.
5. Describe the connections between land use, rural Iowa, and agriculture.
6. Locate a plot of land given a legal description.
7. Explain basic soil morphology and its relationship to management.
8. Explain the impact agriculture, industry, and population centers have on natural resources and the environment.
9. Use soil survey, topography maps, aerial photos, and other natural resources inventories to interpret, compare (limits and potentials), and plan wise land management.
10. Identify federal, state, and local regulations related to soil and water conservation, water quality, forestry, air quality, and wildlife. Explain their applicability to resource management.
12. Determine crops and crop management that will provide habitat for wildlife.
20. Describe how Iowa climate and weather is relevant to natural resources and agricultural resource management.
23. Select appropriate conservation practices that will reduce erosion and improve water quality on a farm and urban area.
24. Describe the types of wind and water erosion and determine soil erosion rates and resulting economic and environmental losses to society.
25. Explain the principles of integrated crop (fertility levels, pests) management.
26. Explain the techniques of crop cultivation and how they interrelate with the environment.
28. Explain the importance of protecting ground and surface water resources.
30. Explain current issues involved in natural resource management.
32. Describe current animal waste regulations as they apply to the environment.
33. Explain State and Federal Ag and Natural Resource Management Agencies and their functions.
34. Explain the hydrologic cycle.
35. Identify local sources of ground and surface water contamination and explain techniques for protecting these resources.
36. Identify and incorporate nutrient management practices including spreading lagoon fertilizers, commercial applicator training, composting of manure and animal carcasses, managing wastes from food processing facilities through composting, developing manure management plans, the application of municipal sludge, and the storage, handling, and transfer of chemicals into agricultural plans.
40. Incorporate wildlife depredation prevention into animal husbandry practices.

Agricultural Mechanics

Standard AM-12: Understand basic technical skills and knowledge in the occupational area of agricultural mechanics.

Benchmark

L. Apply technical skills in a hands-on experiential setting in agriculture.

26 Identify types of erosion control structures.

Source: Iowa Content Standards and Benchmarks for Agricultural Education, Iowa Department of Education, 1999.

Science Standards

Standard 2: Understands Earth's composition and structure

Level III

3. Knows components of soil and other factors that influence soil texture, fertility, and resistance to erosion (e.g., plant roots and debris, bacteria, fungi, worms, rodents)

Level IV

3. Knows that elements exist in fixed amounts and move through the solid Earth, oceans, atmosphere, and living things as part of geochemical cycles (e.g., carbon cycle, nitrogen cycle)

4. Knows that throughout the rock cycle (e.g., formation, weathering, sedimentation, reformation), the total amount of material stays the same as its form changes

6. Knows the conditions of Earth that enable it to support life (e.g., force of gravity that enables the planet to retain an adequate atmosphere, intensity of radiation from the Sun that allows water to cycle between liquid and vapor)

Source: Compendium of K-12 Standards, McREL, 2004.

<http://www.mcrel.org/compendium/SubjectTopics.asp?SubjectID=2>